HERA
Poverty-oriented
Basic energy services

Modern Energy Services for Modern Agriculture

Potentials and challenges of smallholder agriculture

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Presentation at the International Conference on Re & Agri
Tunis, Tunisia, 2-4th December 2014

Facts and Figures

2.6 billion people
~ 40% of the world population
make their living from agriculture

Nearly half of all humans live in rural areas

83% of the 537 billion farms are smaller than 2ha and 97% are smaller than 10ha

Small scale farmers are producing most of the food (in Asia and Africa around 80%) and they cultivate around 60% of the global arable land

80% of energy consumed in developing countries is needed for food production

…to bring 2.000 kilocalories

30-50% of food
is wasted

…to the poeple‘s plate…

Post-harvest losses in developing
countries amount to 30%

around 4.600 kilocalories

3.3 billion people worldwide live without
access to sustainable energy

have to be harvest on the field

Modern energy for modern agriculture

Modern Energy source	Energy from	Conver-sion to	Use in agriculture
Solar photovoltaic system	Sun	Heat, Mechanical energy Electricity	PV driven pumps for irrigation, ventilation for solar drying of fruit and vegetables; solar energy for cooling through absorption heat or evaporation driven refrigerator
Wind turbine	Wind	Mechanical energy, Electricity	Powering mechanical or electrical water pumps; agroprocessing activities
Micro-hydropower plant	Water	Mechanical Energy, Electricity	Mechanical or electrical energy for agriculture processing; e.g. milling, pressing
Biomass plant	Organic material	Heat, Electricity, Liquid biofuels, Biogas	Electricity and heat; e.g. heat for drying, refrigeration, fermentation or processes; electricity (industrial biogas) to power electric motors, liquid biofuels for transport or to power combustion engines
Hybrid system	Combi-nation*	Heat, Mechanical energy, Electricity	Used in food processing sector; e.g. grinding of corn, wheat and millet, and milling of grain-hulling paddy

*** of modern Energy with conventional (e.g. diesel generator) – wind/diesel Hybrids; Wind/PV Hybrids**

Energy needs in sustainable value chains for agriculture

Without livestock

Value chain

Transport & Communication

Input	Production	Post-harvest & Storage	Processing	Commer-cialisation & Consumption

Energy needs for

Input	Production	Post-harvest & Storage	Processing	Commer-cialisation & Consumption

▪ Water
▪ Fertilizer
▪ Herbicide etc.
▪ Seeds
▪ Agri. machines
	▪ Land cultivation
	▪ Seeding
	▪ Weeding
	▪ Crop protection
	▪ Irrigation
	▪ Harvest & Threshing
		▪ Packing
		▪ Storage
		  ▪ dry storage
		  ▪ cold storage
			▪ Drying
			▪ Milling
			▪ Grinding
			▪ Pressing
				▪ Logistics
				▪ Marketing
				▪ Distribution
				▪ Cooking

Thermal energy | electrical energy | mecanical energy

Modern enery from

Solar | Biogas | Biomass | Wind | Water | Biofuel

Energy mix

Technical solutions in agricultural value chains

Production

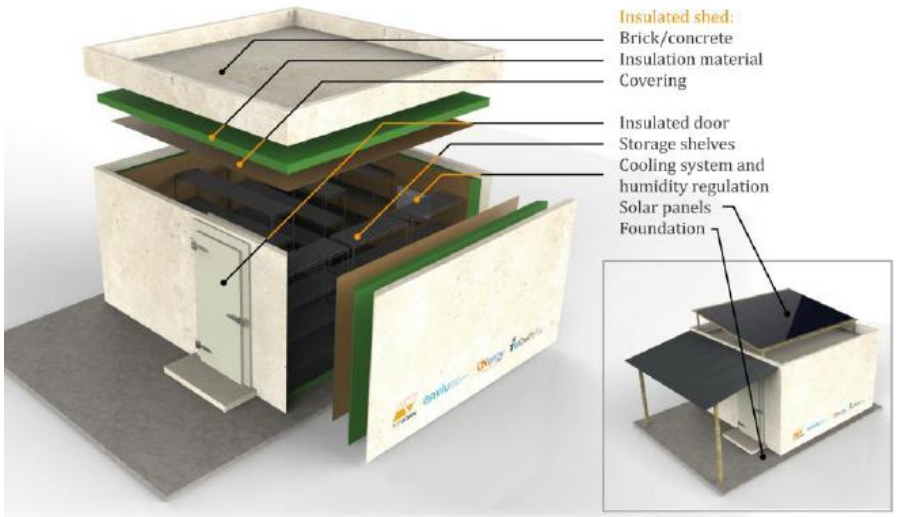
Solar powered irrigation systems (SPIS)

- Highly reliable, low maintenance decentralized irrigation
- Locally adaptable modular structure, water storage and access solutions (e.g. PAYG)
- Increased efficiency through micro irrigation techniques
- GIZ is currently implementing projects on installation, marketization, training and awareness raising on SPIS in Egypt, India, Ghana (via EnDev), Morocco and Senegal

Left: 1,800 Wp surface solar pump, India
(© **GIZ** / Thomas Pullenkav)

Technical solutions in agricultural value chains contin'd

Posthar-vest & Storage



Solar cold storage solutions

- Decentralized solar or solar/grid hybrid systems
- With or without connected energy storage (battery banks)
- Lower wastage and higher prices through greater flexibility in sales
- Implementation example: As part of the IGEN-RE program, GIZ and partner SwitchON develop a hybrid micro cold storage solution for Indian vegetable farmers

Left: Schematic depiction of IGEN-RE solar cold storage solution (source: SwitchON)

Technical solutions in agricultural value chains contin'd

Processing

Solar drying solutions

- Open-air drying spoils up to 70% of produce, risks contamination and overall low quality
- Solar drying options: Active/passive ventilation, solar or solar-hybrid systems, fixed or mobile
- Improves quality, storability and marketability of goods
- Implementation example: EnDev Peru provides technical assistance, trainings and facilitates finance for solar drying solutions tailored to high-value agricultural produce such as coffee, spices or medicinal plants

Left: Solar dryer application for Chili drying, Peru (© **GIZ** / Carlos Bertello)

Technical solutions in agricultural value chains contin'd

Processing

Electric grinding and milling solutions

- Requires reliable off-grid electricity provision, e.g. via mini-grids
- Processing produce locally generates employment, higher market prices for produce and improved access to markets
- Implementation example: Via EnDev Indonesia, GIZ has installed over 400 renewable energy mini-grids in Indonesia to date, facilitating sustainable access to electricity for over 1,600 rural businesses. They support a range of productive applications such as coffee grinding and rice hulling.

Left: Electric coffee grinding in Salumokanan, West Sulawesi (© **GIZ**)

Technical solutions in agricultural value chains contin'd

Processing

Thermal processing solutions

- Thermal processing is a very common step in agroprocessing
- Technical solutions: Fixed or portable, various types (e.g. , rocket stoves, gasifier) and materials (ceramic, metal, stone, etc.)
- Choice of fuels: Renewable (biomass, biogas and solar) or LPG, tailored to resource availability, cost, etc.
- Implementation example: Through Agricultural Development Burkina Faso, GIZ supports local micro-enterprises in processing cassava for the production of starch, ethanol, Cassava flour or Gari

Left: Cassava processing Nigeria Burkina Faso (© **GIZ**)

Technical solutions in agricultural value chains contin'd

Commerciali-sation & Consumption

Improved cookstove (ICS) solutions

- 95% of staple foods require cooking before consumption, 2.64 billion people worldwide utilise biomass fuels for cooking, mostly in a way that is unsustainable and hazardous to health
- Solutions adapted to uses, income levels, resource availability, climatic and housing conditions, local customs, comfort etc.
- GIZ HERA supports planning, local production and marketization, user training, quality assurance and knowledge management on ICS in numerous projects across the globe

Left: Household utlisation of a rocket stove, Uganda (© **GIZ /** Verena Brinkmann)

Important factors influencing the energy-value-chain system beyond technic

Business environment

Empowerment

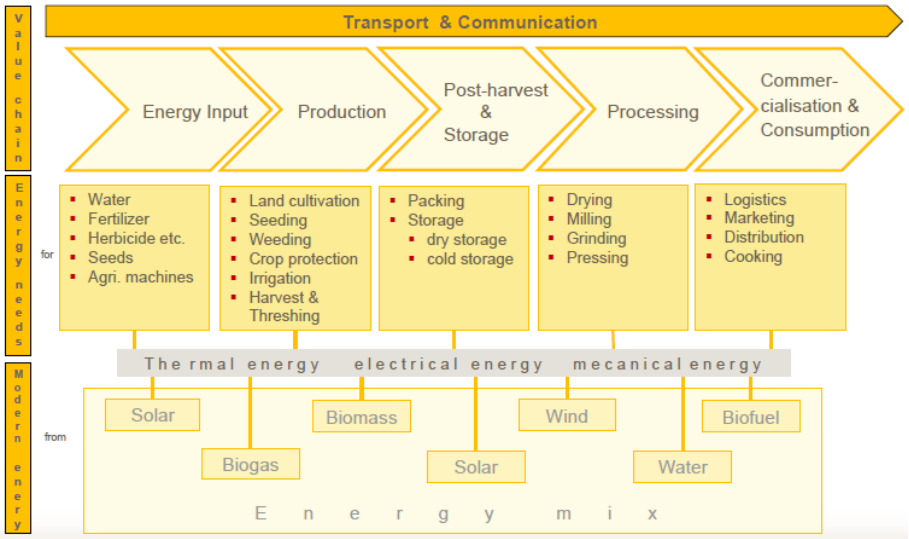
Aspirations

Financing modalities

Energy efficiency

Ownership

Knowledge transfer



Market regulation

Climate

Society

Laws & Legislation

Behaviour

Local government

Operational models

Globalisation

Central government

Access to credit

Tradition

Gender

Access to Information

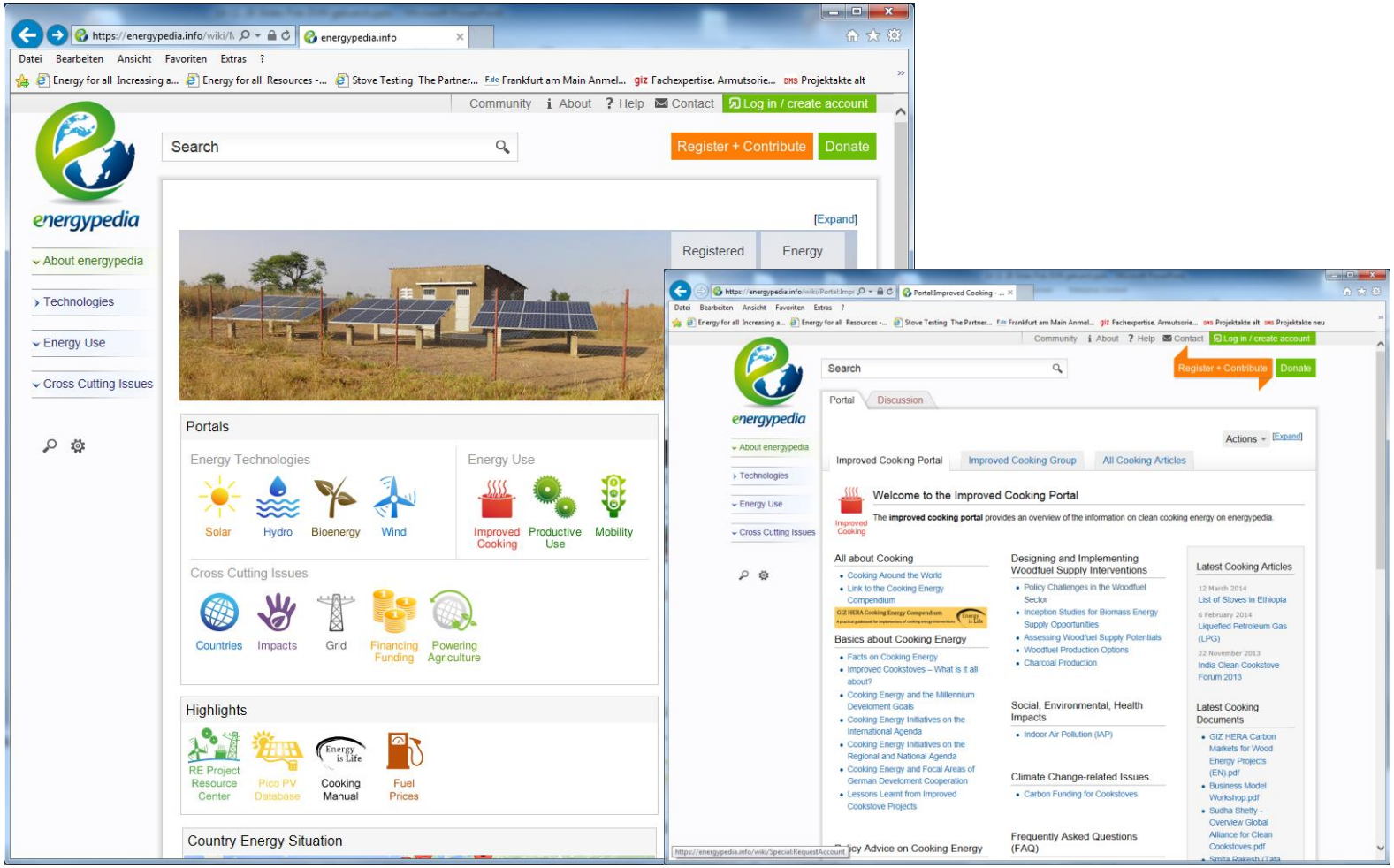
Location

Natural resources

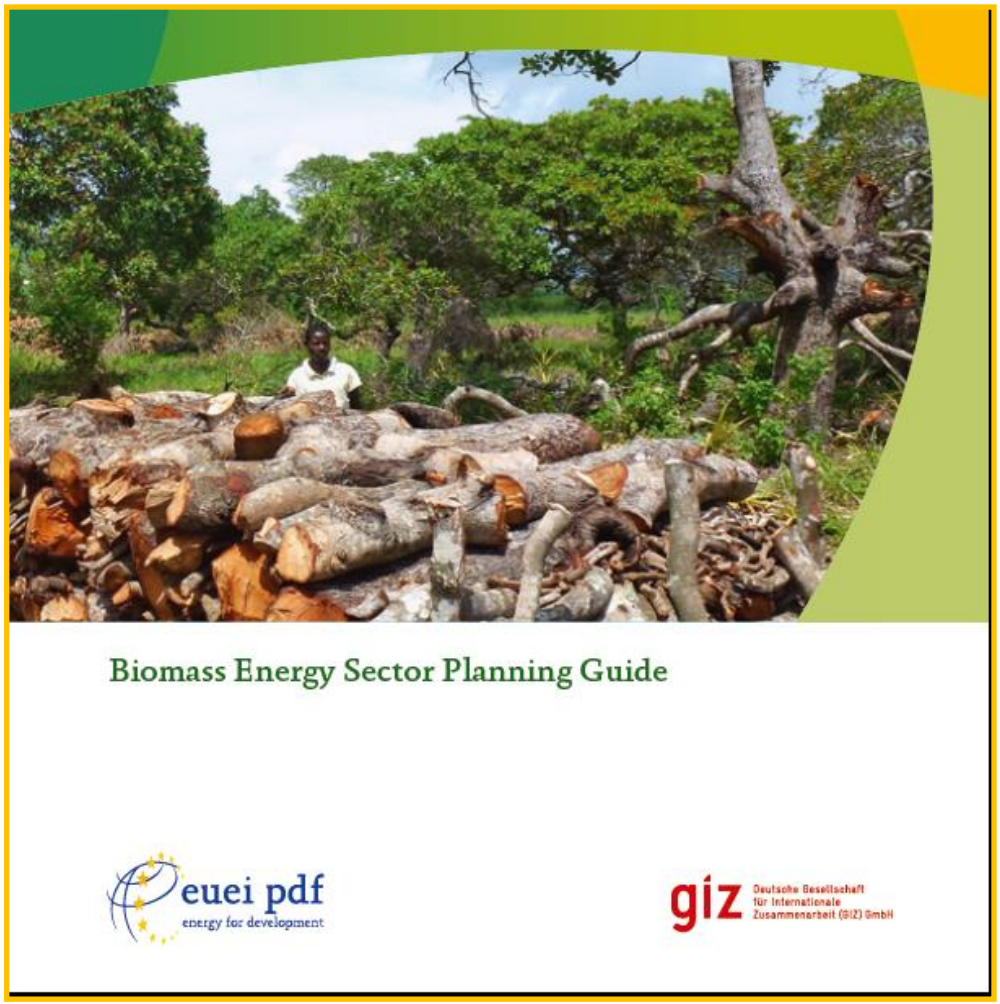
Health

Aspirations

Knowledge transfer – access to information



Support for the Government



Support for the Government

Possibilities for increasing energy efficiency

Energy saving technology

A properly dimensioned of a cooling or drying plant is the first step to energy efficieny – the capacity of overly large systems will not be fully used.

Installation of meter / meter reading / energy record

Regular and carefull maintenance of all technical parts; Replace old and ineffizient equipment – worn parts, v-belt, chain drives – affordability

Behaviour

Short-term thinking

Social comparison - bias for the status quo

Individualist or group oriented (peer effect through learning from each other)

Giving in to temptation, habits

Self-control problems

Trust / mistrust (utility provider, technology, vendors)

Proper operation of the machines and technical equipment? (avoid to rewinding of motors)

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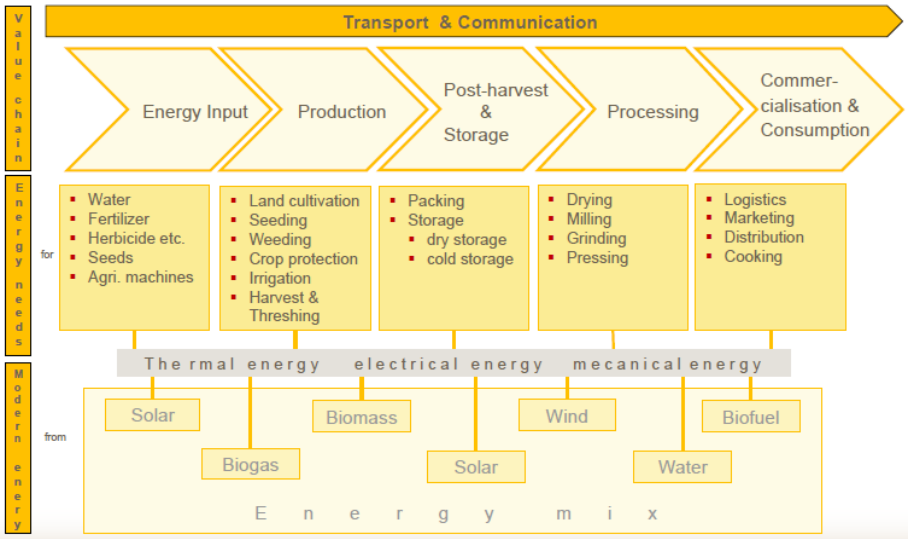

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There is no one size fits all solution !

Thank you for your attention

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